What is claimed is:

1. An electrochemical apparatus, comprising:

an electrochemical cell having first and second electrodes and electrolyte disposed between the first and second electrodes,

a power source for applying a voltage between the first and second electrodes, and

means for automatically retracting one or more of the first and second electrodes out of contact with the electrolyte.

2. The electrochemical apparatus of claim 1, wherein the means for automatically retracting is passive.

3. The electrochemical apparatus of claim 2, wherein the passive means for repetitively retracting is a stored energy device.

4. The electrochemical apparatus of claim 3, wherein the stored energy device is selected from a spring, gravity, hydraulic accumulator, pneumatic accumulator, or combinations thereof.

5. The electrochemical apparatus of claim 1, wherein the electrolyte is an ion exchange membrane.

6. The electrochemical apparatus of claim 1, wherein the one or more of the first and second electrodes includes material that is unstable or deactivates in the presence of the electrolyte without applying a voltage.

7. The electrochemical apparatus of claim 6, wherein the material is lead dioxide.

8. The electrochemical apparatus of claim 7, characterized in that the lead dioxide maintains its activity during repetitive cycling of the power source.

9. The electrochemical apparatus of claim 1, further comprising:

a pump for delivering water to the electrochemical cell, wherein the means for retracting is a hydraulic actuator in fluid communication with the water.

10. The electrochemical apparatus of claim 1, wherein the electrolyte and one of the electrodes are stationary.

11. The electrochemical apparatus of claim 10, wherein the electrolyte is an ion exchange membrane.

12. The electrochemical apparatus of claim 11, wherein the stationary electrode is a cathode.

13. The electrochemical apparatus of claim 1, wherein the electrochemical cell is a stack of electrochemical cells.

14. The electrochemical apparatus of claim 1, further comprising:

a lead-containing catalyst disposed on one or more of the first and second electrodes; and

a lead removal device in fluid communication with the electrochemical cell.

15. The electrochemical apparatus of claim 14, wherein the lead removal device contains a material known to bind or adsorb lead ions, particulates or colloidal species.

16. The electrochemical apparatus of claim 15, wherein the material is selected from a zeolite, alumina, silica, or mixtures thereof.

17. The electrochemical apparatus of claim 15, wherein the material is in powdered or granulated form.

18. The electrochemical apparatus of claim 1, wherein the one or more of the first and second electrodes are retracted out of contact with the electrolyte when no voltage is being applied between the first and second electrodes.

19. The electrochemical apparatus of claim 1, wherein the means for retracting the one or more electrodes further comprises a guide member to align the electrodes.

20. The electrochemical apparatus of claim 1, wherein the means for retracting the electrodes is coupled to the one or more of the first and second electrodes by a positioning rod.

21. The electrochemical apparatus of claim 20, further comprising an electrode chamber having a liquid impermeable diaphragm sealing the chamber and moving along with the positioning rod.

22. The electrochemical apparatus of claim 9, further comprising means for introducing ozone into a separate system.

23. The electrochemical apparatus of claim 22, wherein the ozone comprises dissolved ozone in water, an ozone/oxygen gas stream, or combinations thereof.

24. The electrochemical apparatus of claim 1, further comprising:

means for positioning the first and second electrodes in contact with the electrolyte.

25. The electrochemical apparatus of claim 24, wherein the electrolyte is an ion exchange membrane, and wherein the first electrode is coupled to the means for positioning and the first electrode has an electrocatalyst formed only on surfaces of the first electrode that are disposed to make contact with the ion exchange membrane.

26. The electrochemical apparatus of claim 25, wherein the second electrode is stationary.

27. The electrochemical apparatus of claim 26, wherein the ion exchange membrane is secured onto the second electrode.

28. The electrochemical apparatus of claim 24, wherein the means for positioning is selected from a hydraulic actuator, a pneumatic actuator, manual mechanical means, piezo-electric means, electric motor means, or combinations thereof.

29. The electrochemical apparatus of claim 24, further comprising:

a pump for delivering water to the electrochemical cell, wherein the means for positioning is a hydraulic actuator in fluid communication with the water.

30. The electrochemical apparatus of claim 24, wherein the means for positioning provides a compressive force against the ion exchange membrane generally greater than 15 psig.

31. The electrochemical apparatus of claim 24, wherein the compressive force is between 5 and 100 psig.

32. The electrochemical apparatus of claim 24, wherein the means for retracting overcomes the means for positioning when the power source is off.

33. The electrochemical apparatus of claim 24, wherein the means for positioning overcomes the means for retracting when the power source is on.

34. The electrochemical apparatus of claim 24, wherein the means for positioning the electrodes further comprises a guide member to align the electrodes.

35. The electrochemical apparatus of claim 24, wherein the means for positioning the electrodes is coupled to the one or more of the first and second electrodes by a positioning rod.

36. The electrochemical apparatus of claim 35, further comprising an electrode chamber having a liquid impermeable diaphragm sealing the chamber and moving along with the positioning rod.

37. The electrochemical apparatus of claim 35, wherein the positioning rod comprises an electronic conductor communicating between a voltage source and the one or more of the first and second electrodes.

38. The electrochemical apparatus of claim 24, further comprising a water reservoir in fluid communication with an inlet to the pump and in fluid communication with an outlet from the electrochemical cell.

39. The electrochemical apparatus of claim 38, further comprising a recirculation conduit from an outlet of the pump back to the water reservoir.

40. The electrochemical apparatus of claim 39, further comprising means for apportioning the amount of water pumped to the electrochemical cell and the amount of water recirculated back to the water reservoir.

41. The electrochemical apparatus of claim 24, further comprising an ion exchange bed disposed upstream of the electrochemical cell.

42. The electrochemical apparatus of claim 41, further comprising an ozone destruct catalyst upstream of the ion exchange bed.

43. The electrochemical apparatus of claim 24, wherein the electrochemical cell is a fuel cell.

44. An electrochemical apparatus, comprising:

an electrochemical cell having first and second electrodes and electrolyte disposed between the first and second electrodes,

a power source for applying a voltage between the first and second electrodes, and

means for passively retracting one or more of the first and second electrodes out of contact with the electrolyte.

45. An electrochemical apparatus, comprising:

an electrochemical cell having first and second electrodes and electrolyte disposed between the first and second electrodes,

a power source for applying a voltage between the first and second electrodes,

means for selectively positioning one or more of the first and second electrodes into contact with the electrolyte; and

means for retracting the one or more of the first and second electrodes out of contact with the electrolyte when the means for selectively positioning is turned off.

46. A method of operating an electrochemical cell having first and second electrodes and electrolyte disposed between the first and second electrodes, comprising:

(a) automatically separating one or more of the first and second electrodes from the electrolyte upon one or more standby conditions.

47. The method of claim 46, wherein the one or more standby conditions is selected from a voltage of less than one Volt being applied between the first and second electrodes, expiration of a time period, an ozone concentration greater than a setpoint ozone concentration, contact pressure of less than 10 psig, or combinations thereof

48. The method of claim 46, further comprising:

(b) automatically positioning the one or more of the first and second electrodes into contact with the electrolyte upon one or more production conditions.

49. The method of claim 48, wherein the one or more production conditions is selected from a voltage greater than one Volt being applied between the first and second electrodes, expiration of a time period, an ozone concentration less than a setpoint ozone concentration, contact pressure greater than 10 psig, or combinations thereof.

50. The method of claim 48, wherein the electrolyte is a polymer electrolyte membrane, and wherein the step of automatically positioning comprises compressing the one or more of the first and second electrodes against the polymer electrolyte membrane with a compressive force between 5 and 100 psig.

51. The method of claim 50, wherein the compressive force is between 25 and 70 psig.

52. The method of claim 48, further comprising:

applying a voltage between the first and second electrodes.

53. The method of claim 52, further comprising:

turning on a water pump.

54. The method of claim 53, further comprising:

automatically positioning the one or more of the first and second electrodes into contact with the electrolyte upon one or more production conditions.

55. An electrode, comprising:

a porous metal substrate having a substantially nonporous metal current collector is at least partially embedded within the substrate; and

an electrical connector coupled to the metal current collector and extending from the porous metal substrate.

56. The electrode of claim 55, wherein the porous metal substrate is sintered around metal current collector.

57. The electrode of claim 56, wherein the metal current collector is entirely embedded within the porous metal substrate.

58. The electrode of claim 55, wherein the electrical connector forms part of a shaft coupled to the porous metal substrate.

59. The electrode of claim 58, characterized in that the porous metal substrate may be moved by actuating the shaft.

60. A method for controlling the voltage applied to an ozone generator including an anode substrate with a lead dioxide anodic electrocatalyst, a cathode, and a proton exchange membrane in contact between the lead dioxide and the cathode, the method comprising:

separating the lead dioxide out of contact with the proton exchange membrane; then
waiting for an interval of time; and then
reducing the voltage.

61. The method of claim 60, wherein the step of reducing the voltage comprises turning off the voltage.

62. The method of claim 60, wherein the voltage is reduced to a setpoint voltage for maintenance of the lead dioxide anodic electrocatalyst.

63. A method for controlling the voltage applied to an ozone generator including an anode substrate with a lead dioxide anodic electrocatalyst, a cathode, and a proton exchange membrane in contact between the lead dioxide and the cathode, the method occurring while the lead dioxide is maintained in contact with the proton exchange membrane, the method comprising:

determining the present value of a parameter selected from cell voltage and cell current
identifying a setpoint for the parameter; and

adjusting the power applied to the ozone generator so that the parameter is changed from the present value to the setpoint over a period of time.

64. The method of claim 63, wherein the power is adjusted gradually until reaching the setpoint for the parameter.

65. The method of claim 63, wherein the power is adjusted in increments until reaching the setpoint for the parameter.

66. A method for controlling the voltage applied to an ozone generator including an anode substrate with a lead dioxide anodic electrocatalyst, a cathode, and a proton exchange membrane in contact between the lead dioxide and the cathode, the method comprising:

separating the lead dioxide out of contact with the proton exchange membrane if the voltage between the anode substrate and the cathode becomes less than a setpoint voltage.

67. The method of claim 66, wherein the setpoint voltage is about one Volt.

68. An electrochemical cell including a cathode electrode, an anode electrode, an acidic electrolyte disposed between the anode electrode and the cathode electrode, and a power source for applying a voltage between the anode electrode and the cathode electrode, characterized in that the anode electrode has a layer of lead dioxide electrocatalyst facing the acidic electrolyte, a retractor mechanism being provided which is responsive to one or more predetermined standby conditions to retract the anode electrode from an initial position in which the lead dioxide electrocatalyst is in contact with the electrolyte to a retracted position in which the lead dioxide electrocatalyst is spaced from the electrolyte.

69. The cell of claim 68 wherein the retractor mechanism is a passive retraction mechanism.

70. The cell of claim 68 wherein the lead dioxide electrocatalyst is β-lead dioxide, α-lead dioxide, or a combination thereof.

71. The cell of claim 68 wherein the acidic electrolyte is a proton exchange membrane.

72. The cell of claim 68 wherein the acidic electrolyte is an aqueous solution of a dissolved inorganic acid, a dissolved organic acid, or a mixture thereof.

73. The cell of claim 68 wherein the one or more standby conditions are selected from:

a voltage of less than one volt being applied between the first and second electrodes, the expiration of a time period of operation of the cell, an ozone concentration greater than a set point ozone concentration within the cell, no anodic oxygen/ozone evolution reactions occurring, and no current flowing through the cell.

74. The cell of claim 71 wherein the one or more standby conditions includes a contact pressure of less than 10 psig of the anode electrode with the proton exchange membrane.

75. The cell of claim 68 further comprising an actuator for moving the anode electrode from the retracted position back to the initial position in response to one or more production conditions.

76. The cell of claim 75 wherein the one or more production conditions are selected from:

a voltage greater than one volt being applied between the first and second electrodes, the expiration of a time period from termination of operation of the cell, and an ozone concentration less than a set point ozone concentration within the cell.

77. The cell of claim 71 further comprising an actuator for moving the anode electrode from the retracted position back to the initial position in response to one or more production conditions including a contact pressure of greater than 10 psig of the anode electrode with the electrolyte.

78. The cell of claim 75 wherein the retractor mechanism and the actuator are constituted by a passive device biasing the anode electrode away from the electrolyte and an active mechanism which, in operation, overcomes the biasing effect of the passive device to move the anode electrode

into contact with the electrolyte.

79. The cell of claim 78 wherein the active mechanism receives power from the power source so that when the power source is connected to apply a voltage between the anode electrode and the cathode electrode the power source provides power to the active mechanism.

80. The cell of claim 68 wherein the lead dioxide electrocatalyst retains its β-lead dioxide crystalline form.

81. A method for generating ozone in an electrochemical cell having a cathode electrode, an anode electrode, an acidic electrolyte disposed between the anode electrode and the cathode electrode, and a voltage source coupled between the anode electrode and cathode electrode, the method comprising the steps of applying a voltage between the anode electrode and the cathode electrode characterised in that the method further comprises the steps of initially moving the anode electrode from a retracted position in which it is spaced from the electrolyte to an operative position in which it is in contact with the electrolyte, and turning the voltage source on before or simultaneously with the engagement of the anode with the electrolyte, the method further comprising a step of retracting the anode electrode out of contact with the acidic electrolyte shortly before or simultaneously with turning off the voltage source.

82. The method of claim 71 wherein the step of retracting the anode electrode out of contact with the acidic electrolyte is effected in response to sensing of one or more predetermined standby conditions.

83. The method of claim 82 wherein the one or more standby conditions are selected from:

a voltage of less than one volt being applied between the first and second electrodes, expiration of a time period of operation of the cell, an ozone concentration greater than a setpoint ozone concentration within the cell, no anodic oxygen/ozone evolution reactions occurring, and no current flowing through the cell.

84. The method of claim 81 wherein the acidic electrolyte is a proton exchange membrane and wherein the one or more standby conditions includes a contact pressure of less than 10 psig of the anode electrode with the proton exchange membrane.

85. The method of any one of claims 81 wherein the engagement of the anode electrode into contact with the electrolyte is effected in response to the sensing of one or more production conditions.

86. The method of claim 85 wherein the one or more production conditions are selected from:

a voltage greater than one volt being applied between the first and second electrodes, the expiration of a time period from termination of operation of the cell, and an ozone concentration less than a set point ozone concentration within the cell.

87. The cell of claim 80 further comprising an actuator for moving the anode electrode from the retracted position back to the initial position in response to one or more production conditions, wherein the acidic electrolyte is a proton exchange membrane, and wherein the one or more production conditions includes a contact pressure of greater than 10 psig of the anode electrode with the proton exchange membrane.

88. An electrochemical cell including a cathode electrode, an anode electrode, an acidic electrolyte disposed between the anode electrode and the cathode electrode, and a power source for applying a voltage between the anode electrode and the cathode electrode, characterized in that the apparatus further comprises a mechanism to retract the anode electrode out of contact with the electrolyte in response to the absence of a current flowing through the electrochemical cell.

89. An electrochemical cell including a cathode electrode, an anode electrode, and an acidic electrolyte disposed between the anode electrode and the cathode electrode, and a power source for applying a voltage between the anode electrode and the cathode electrode, characterized in that the apparatus further comprises a passive mechanism biasing the anode electrode away from the electrolyte and an active mechanism which, when operative, overcomes the biasing effect of the

passive mechanism to bring the anode electrode into contact with the electrolyte.

90. The electrochemical cell of claim 89 wherein the active mechanism is adapted to be actuated when the power source is connected to apply the voltage between the electrodes.

91. An electrochemical cell including a cathode electrode, an anode electrode, an acidic electrolyte disposed between the anode electrode and the cathode electrode, and a power source for applying a voltage between the anode electrode and the cathode electrode, characterized in that the apparatus further comprises a mechanism to retract the anode electrode out of contact with the electrolyte to interrupt a circuit incorporating the cell, thereby placing the cell in a standby condition.